

ARAC: EARLY PHASE DOSE
ASSESSMENT FOR THE DOE FRMAP

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The Atmospheric Release Advisory Capability (ARAC)^[1,2,3] is a United States government Department of Energy (DOE)-sponsored emergency-response service designed, developed, and established at Lawrence Livermore National Laboratory (LLNL) to provide real-time predictions of the radiation dose levels and the extent of surface contamination resulting from a broad range of possible occurrences or accidents that could involve the release of airborne radioactive material. During its 15-year lifetime, ARAC has responded to more than 300 real-time situations and exercises. Some of the most notable responses include the Three Mile Island (TMI) accident^[4] in Pennsylvania, USA, the Titan II missile accident^[5] in Arkansas, USA, the reentry of the U.S.S.R.'s COSMOS-954 into the atmosphere over Canada, the accidental release of uranium hexafluoride from the Sequoyah Fuels Facility accident^[6] in Oklahoma, USA, and, most recently, the Chernobyl reactor accident^[7,8] in the Soviet Union. On several occasions, ARAC has served on extended alerts, e.g., for COSMOS 1402 (1983) and COSMOS 1900 (1988), or served in an advisory and confirmatory role for the US federal government, such as for the purge of the Krypton 85 from the TMI containment in the summer of 1980.

ARAC currently supports the emergency preparedness plans and activities at Department of Defense (DOD) and DOE sites within the U.S., and also responds to any accidents that the U.S. has interest in, e.g., Chernobyl. Our ARAC center serves as the focal point for data acquisition, data analysis, and assessments during a response, using a computer-based communication network to acquire real-time weather data from the accident site

(supported facilities) and the surrounding region, as well as pertinent accident information. Its three-dimensional models for atmospheric dispersion process all this information and produce the short-term (2-6 hour) projections used in accident assessment.

As the power of computers has evolved inversely with respect to cost and size, ARAC has expanded its service and reduced the response time from hours to minutes for an accident within the United States. Concurrently the quality of the assessments has improved as more advanced models have been developed and incorporated into the ARAC system. Over the past six years, the number of directly connected facilities has increased from 6 to 73. All major U.S. Federal agencies now have access to ARAC via the Department of Energy as specified in the U.S. Federal Radiological Emergency Response Plan (FRERP). This assures a level of consistency as well as experience. ARAC maintains its real-time skills by participation in approximately 150 exercises per year; ARAC also continuously validates its modeling systems by application to all available tracer experiments and data sets.

Support for DOE is not only provided to specific sites/facilities, but also to its specialized emergency response and assessment organizations, i.e., the Nuclear Emergency Search Team (NEST), the Accident Response Group (ARG), and the Federal Radiological Monitoring and Assessment Center (FRMAC). ARAC participates in most major exercises of these groups. DOD also receives ARAC support for its many major exercises, training courses, and accident manual/procedures development. Exercise preparation and development for DOE, DOD, and the Nuclear Regulatory Commission (NRC) is another frequently utilized aspect of the ARAC service.

In the event of a radiological accident which leads to implementation of the FRERP, DOE is responsible to activate a Federal Radiological Monitoring and Assessment Program (FRMAP). ARAC is the modeling or simulation capability which would provide the FRMAP with initial consequence assessments and visual depictions of an accident's

impact. From first alert until full staffing and activation of the Federal Radiological Monitoring and Assessment Center (FRMAC), ARAC's calculations would be nearly the sole source of consequence estimation. Once the FRMAC measurement and monitoring systems are activated (24-48 hours), then the ARAC calculations begin to transition over to roles such as (1) a reference for measurement data consistency checks, (2) source term derivation (if unknown) from measurements and model simulations, (3) material mass budget reconciliations and (4) long range consequence, detectability and ultimate fate in the environment.

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ARAC Response Time

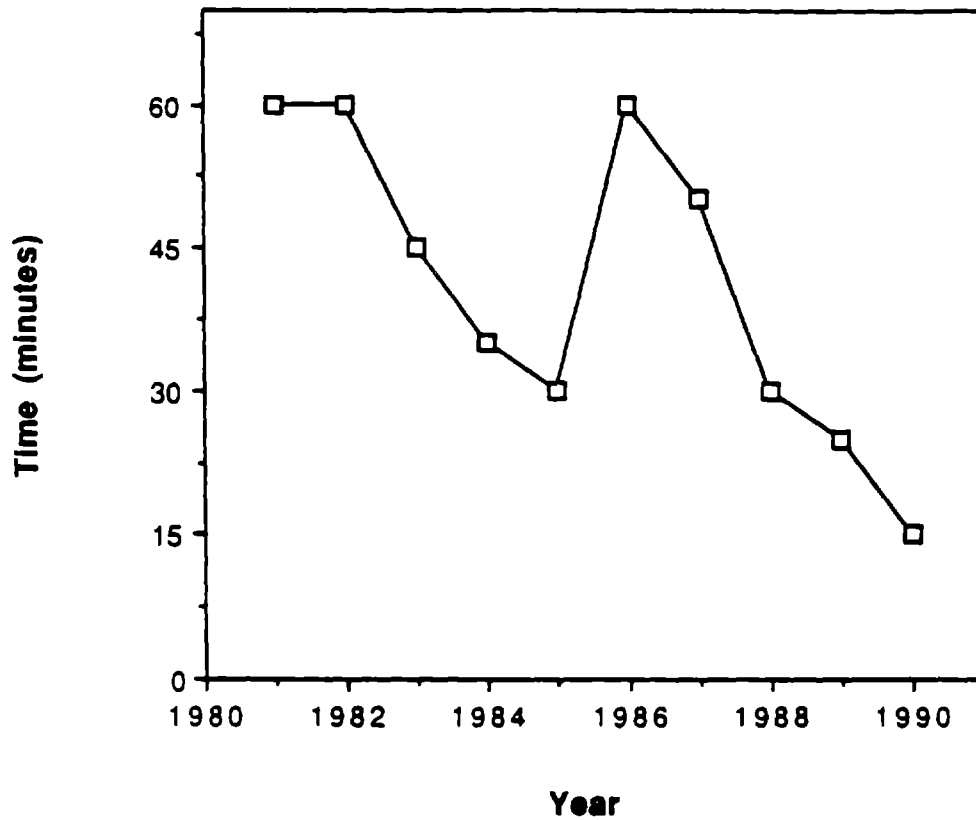


Figure 1. This plot shows how automation of the data acquisition process, databases, and manual tasks has steadily improved ARAC's initial response time. Note that ARAC moved from a CDC 7600 to a DEC VAX in 1986 and to a VAX 8550 in 1988.

ARAC Workload and Staffing

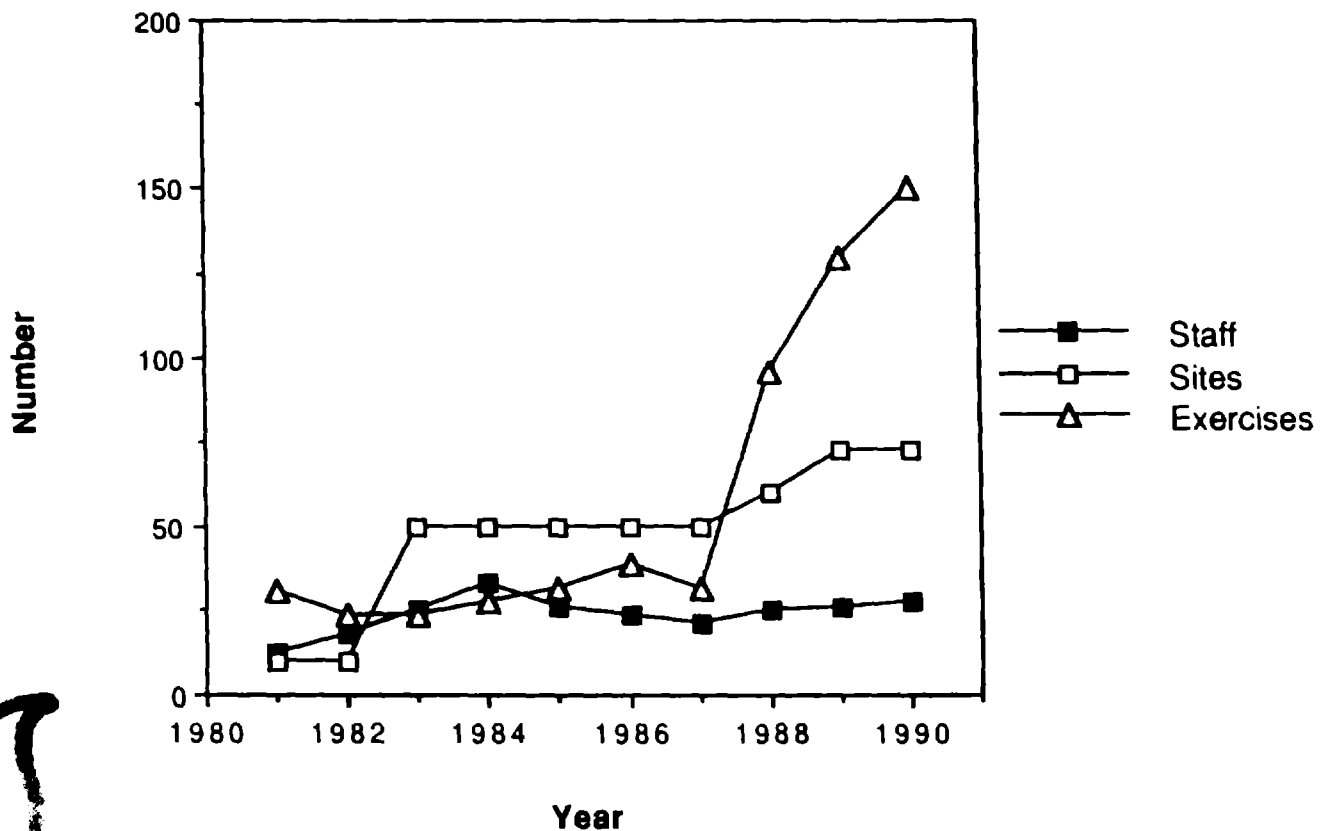


Figure 2. The benefits of automation to productivity are evident in this plot, which shows the chronology of the number of ARAC staff, the number of supported sites, and the number of training/preparedness exercises. It would not be possible to provide the ARAC service to the large number of supported sites and conduct so many exercises without the extensive automation and integration of capabilities as discussed in this report.